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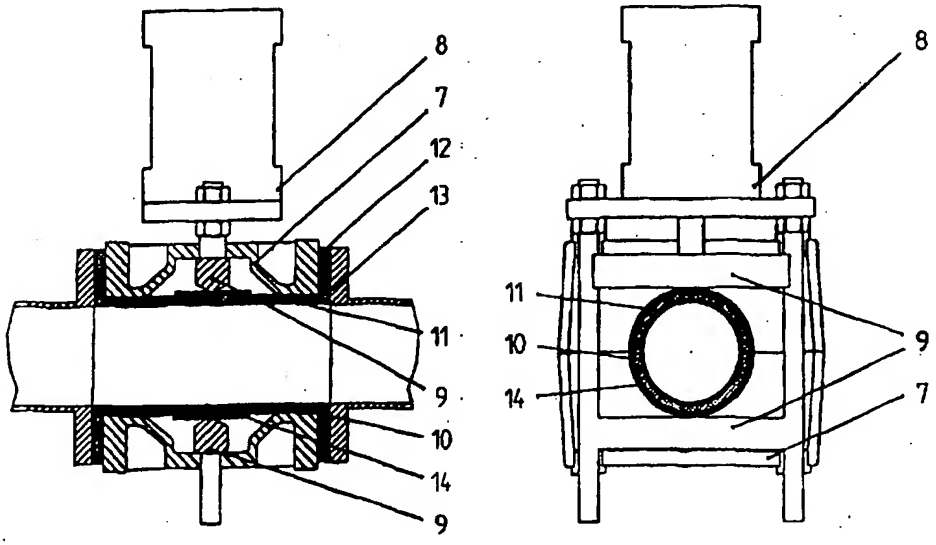

(57) Abstract

The invention relates to a valve, particularly a pinch valve, comprising a body part (7) and a body hose (10) which may be a fabric-reinforced hose, metal braid hose, textile fabric hose or similar material capable of resisting the operating pressure of the piping. According to the invention, said body hose (10) is complemented with at least one separate lining or similar protective structure (11, 14) protecting said body hose (10).

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REINFORCED PINCH CONTROL VALVE STRUCTURE

The present invention relates to a valve structure according to the preamble of claim 1.

Pinch valves are conventionally used in the piping of process industry as stop and/or control valves. The main elements of a typical pinch valve are shown in Fig. 1 comprising a valve body, an elastic hose and an actuator. To close the valve, two parallel jaws moved by an actuator are pressed against the hose simultaneously from both sides, whereby the lumen of the hose is obstructed thereby cutting off the flow along the piping.

The elastic hose is conventionally made from rubber into which reinforcements, typically woven textile fabric plies are embedded. The reinforcing layers act as the strength-imparting component of the hose serving to resist the internal pressure, and their quantity is dependent on the pressure rating of the hose. The inner rubber lining of the hose both forms the seal zone during the closing of the valve and protects the reinforcing plies against the physical wear and chemical attack imposed by the medium contained in the hose. The outer rubber lining surrounding the hose perimeter protects the reinforcing plies against mechanical wear by the pressing jaws.

The fabrication process of the valve hose requires a great amount of physical labour, because the rubber compound and reinforcing plies must be placed manually over the manufacturing tool. While the rubber compound is most conventionally natural rubber or similar, chemically and/or thermally stressing operating conditions of the pinch valve may necessitate the use of special rubber compounds. Herein, problems may arise in the adherence of the rubber layers to each other or the reinforcing plies.

The hose is a consumable element of the pinch valve that must be replaced when damaged. Eroding media usually invoke the replacement need due to abrasion of the hose inner lining, whereby the valve fails to close tightly. Progress of inner lining abrasion may also expose the reinforcing fabrics, which can cause bursting of the hose. In some applications, the chemicals passed by and/or elevated operating temperature of the pinch valve may lead to embrittlement of the hose inner lining. Also pressure shocks travelling in the piping can cause damage to the hose reinforcing fabrics particularly if the reinforcing plies are subjected to chemical attack due to damage in the hose inner lining. Normally, as the progress of damage in the hose inner layers cannot be detected visually from outside, hose failure will become evident only through the bursting of the hose or as incomplete closing of the pinch valve.

After the detection of a local hose damage (e.g., abrasion damage in the hose inner surface), the full length of the hose must be replaced even if otherwise in good condition or not. Also the entire valve body must be dismantled to carry out the replacement of the relatively stiff hose.

It is an object of the present invention to provide an arrangement in which the service life of the technically complicated, and therefore, rather costly valve hose can be extended by virtue of a simple and easily replaceable accessory. The characterizing properties of the arrangement according to the invention are disclosed in the appended claims.

A pinch valve according to the invention comprises a body part, an actuator and a valve hose formed by at least two parts including a pressure-resistant hose and an easily replaceable protective hose, or alternatively, components acting as an equivalent lining surface or protective structure. Said replaceable protective hose or equivalent lining surface or protective structure can be inserted inside the lumen of the pressure-resistant valve hose so as to

receive therein the erosive/chemical/thermal stresses imposed by the medium contained in the valve hose. Additionally, a detachable hose can be pulled over the perimeter of the actual valve hose to receive the abrasive action of the pinching jaws.

The invention is characterized by having the valve hose assembled into an entity formed from a two or a greater number of detachable parts. This arrangement makes it possible to indicate the need for the protective hose replacement and simplify the servicing operations. As explained above, the valve hose according to the invention is repaired by replacing the damaged component of the hose assembly only, instead of installing an entirely new hose.

In the case that detachable protective hose according to the invention becomes damaged, it can be readily replaced by a new insertable protective hose element without the need for removing the pressure-resistant reinforced hose element.

Although hose replacement in conventional structures is a relatively uncomplicated operation, which can be carried out without the use of special tools, the novel hose structure makes valve maintenance still faster. Herein, the inside protective hose can be replaced without dismantling the pinch valve, simply by inserting a new inner protective hose element into the lumen of the reinforced hose element. This facility shortens the servicing downtime of the valve appreciably.

The manufacturing costs of the detachable protective hose element according to the invention become advantageous, because the hose element can be normally fabricated without any reinforcing plies, whereby its manufacture will be simplified. Further, the use of a detachable hose element permits the conventional rubber compounds to be replaced by special

materials, since no adherence problems with reinforcing plies will be encountered. As such special compounds (e.g., silicone rubber and fluoro-elastomer compounds) generally are expensive, the valve hose structure according to the invention offers significant savings. To resist chemical attack, a special material is needed for making the detachable inner hose element only, not for the entire thickness of a reinforced integral hose.

The use of a detachable inner protective hose element permits the hose structure to be complemented with different kinds of damage indication systems to detect a failure of the inner hose element. If the inner hose element is punctured due to mechanical wear, for instance, the liquid medium contained in the piping can enter the space between the concentric hose elements. By inserting a moisture detector in the interhose space, an immediate indication of inner hose element failure can be obtained. One alternative option is to place a dye in the interhose space. Then, an inner hose element failure will release the dye into the liquid medium contained in the piping, thereby giving a visual indication of a hose damage.

The arrangement according to the invention makes it easy to test the compatibility of different elastomer compounds with the medium contained in the piping as the inner hose element is easy to fabricate, the material quantity required for the hose element is small and no adherence problems typically associated with the use of special materials will be met.

The pinch valve according to the invention is particularly characterized in that the valve is implemented with standardized hose dimensions, which means that the cross section of the valve hose lumen to flow will not be reduced nor the valve hose length increased. As described above, the detachable inner hose element will not be an accessory to be inserted in the lumen of a standard hose, but rather forms a single complementary structure with the pressure-resistant hose element.

In the following, the invention will be examined in greater detail with the help of an exemplifying embodiment by making reference to the appended drawings in which

Figure 1 shows a conventional pinch valve equipped with a single-element integral valve hose viewed from two directions; and

Figure 2 shows an equivalent pinch valve equipped with a valve hose structure according to the invention.

Referring to Fig. 1, therein is shown a prior-art pinch valve comprising a body part 1, an elastic fabric-reinforced hose 2 and an actuator 3, which can be a pneumatic cylinder, for instance. Generally, the pinch valve hose 2 has flanges 4, which simultaneously perform a sealing function during the connection of the pinch valve to a piping 5. To close the pinch valve, the actuator closes the lumen of the elastic hose 2 by applying a pressure thereon with the help of parallel jaws 6 placed on both sides of the hose.

In Fig. 2 is shown a valve embodiment according to the present invention comprising a conventional body part 7, an actuator 8 and two parallel pinching jaws 9. The elastic valve hose according to the invention is formed by a body hose 10 capable of resisting the operating pressure of the piping and by at least one detachable inner protective hose element 11 inserted in the lumen of the body hose, thus facilitating an easy replacement of the inner hose element(s).

The end of the inner hose element 11 is advantageously extended past the flange 12 of the body hose 10 so as to form a sealing flange 13. Thus, the material of the inner hose element 11 can completely protect the other elements of the pinch valve against chemical attack of the medium contained in the piping, simultaneously acting as a seal in the connection

of the pinch valve to the piping. This arrangement provides a simple and reliable method of fixing the inner hose element to the pinch valve structure. If required, more than one inner hose element 11 can be inserted in the lumen of the body hose 10, whereby the wall thickness, composition, surface structure and other properties and shape of the inner hose element sections can be varied as required. The inner hose sections 11 can be designed to protect either the entire body hose 10 or only a certain section of the body hose. The inner hose elements can be arranged in superimposed layers and/or successively extended along the hose length to protect a partial section or sections of the body hose 10. If one or a greater number of additional hoses are used to protect only a partial section or sections of the body hose, they are advantageously placed in the interhose space between the full-length inner hose section protecting the body hose and the body hose proper.

The detachable inner protective hose element 11 provides the required resistance to the mechanical wear and/or chemical attack caused by the medium contained in the piping, as well as a portion of the required thermal resistance. The inner protective hose element 11 can be advantageously made relatively thin-walled and without reinforcements, which makes its replacement an uncomplicated operation in the case of a valve hose failure. After the pinch valve is disconnected from the piping for hose replacement, the inner protective hose 11 can be replaced without special tools. By contrast, the replacement of the valve hose in a conventional pinch valve requires the dismantling of the valve body 1 to permit the replacement of a stiff, pressure-resistant, reinforced valve hose 2.

A moisture detector can be readily mounted in the interhose space between the inner protective hose element 11 and the body hose 10, whereby a failure of the inner hose element is easy to indicate. Such a detector is simply formed by two insulated electrical conductors introduced from

outside into the interhose space with the conductor ends left void of insulation in the interhose space. As the interhose space is normally dry, the resistance between the spaced-apart conductor ends will be high. When the interhose space becomes filled with a liquid during a hose failure, the resistance between the conductor ends will be reduced thus indicating a hose failure. Obviously, a failure detection system based on resistance change can be replaced by other methods such as a system based on capacitance change.

In circuits permitting later visual detection of the flowing medium, the interhose space between the inner protective hose 11 and the body hose 10 can be filled with a dye, which is released into the flowing medium during an inner hose element failure.

In some installations involving a large number of operating cycles or requiring a hose of high pressure rating, the jaws 9 may cause a failure of the body hose 10 due to external abrasion. To counter such damage mechanisms, the body hose 10 can be protected according to the invention against such external wear by placing a separate detachable sheath element 14 at least over the section of the body hose subjected to the pressing of the pinching jaws.

As the inner protective hose 11 is impermeable to the contained medium, the body hose 10 may in principle be made from a metal wire braid, textile fabric or similar material. Then, the detachable inner protective hose 11 conducts the liquid, gas or other medium carried by the piping, while the woven-fabric-reinforced body hose receives the mechanical stresses.

To a person versed in the art, it is obvious that the embodiments of the invention are not limited to the examples described above, but instead can be varied within the scope and spirit of the appended claims.

Claims:

1. A pinch valve comprising a body part (7), a body hose (10) made from, e.g., a fabric-reinforced hose, metal braid hose, textile fabric hose or similar material capable of resisting the operating pressure of the piping, c h a r a c t e r i z e d in that said body hose (10) is detachably provided with at least one protective lining (11, 14) or a similar structure acting as a protection of said body hose (10) and forming a complementary valve hose structure therewith.

2. A pinch valve as defined in claim 1, c h a r a c t e r i z e d in that the lining or protective structure placed in the lumen or outside said body hose (10) is an elastic, separate and replaceable element, advantageously an inner hose element (11), a sheath element (14) or similar structure with a design not affecting the cross section or path length of the flow passing through the body hose.

3. A pinch valve as defined in claim 1 or 2, c h a r a c t e r i z e d in that the end of the inner hose element (11) or similar structure is extended past the flange (12) of the body hose (10) so as to form a seal flange (13).

4. A pinch valve as defined in any of foregoing claims 1 - 3, c h a r a c t e r i z e d in that the inner hose element (11) or similar structure is advantageously a thin and nonreinforced lining with a wall thickness of 1 - 20 mm, preferably 3 - 10 mm.

5. A pinch valve as defined in any of foregoing claims 1 - 4, c h a r a c t e r i z e d in that the inner hose element (11) or similar protective structure is designed compatible with the properties of the chemical contained in the piping.

6. A pinch valve as defined in any of foregoing claims 1 - 5, characterized in that the interhose space between the inner hose element (11) and the body hose (10) can be provided as required with, e.g., a detector sensitive to moisture, pressure or similar variable, or a dye or similar indicator.

7. A pinch valve as defined in any of foregoing claims 1 - 6, characterized in that the wall thickness, material composition, plies, surface structure and other design parameters and shape of the inner hose element (11) and/or the sheath element (14) are made variable according to different user needs.

8. A pinch valve as defined in any of foregoing claims 1 - 7, characterized in that at least one of the linings or similar protective structures protecting the body hose (10) such as the inner hose element (11) or respectively a sheath element (14) outside the body hose are dimensioned to protect either the entire length of the body hose (10) or only a certain portion of said body hose (10).

9. A pinch valve as defined in any of foregoing claims 1 - 8, characterized in that the lining or similar protective structure protecting the body hose (10) such as the at least one inner hose element (11) are dimensioned to protect the body hose (10) independently from each other.

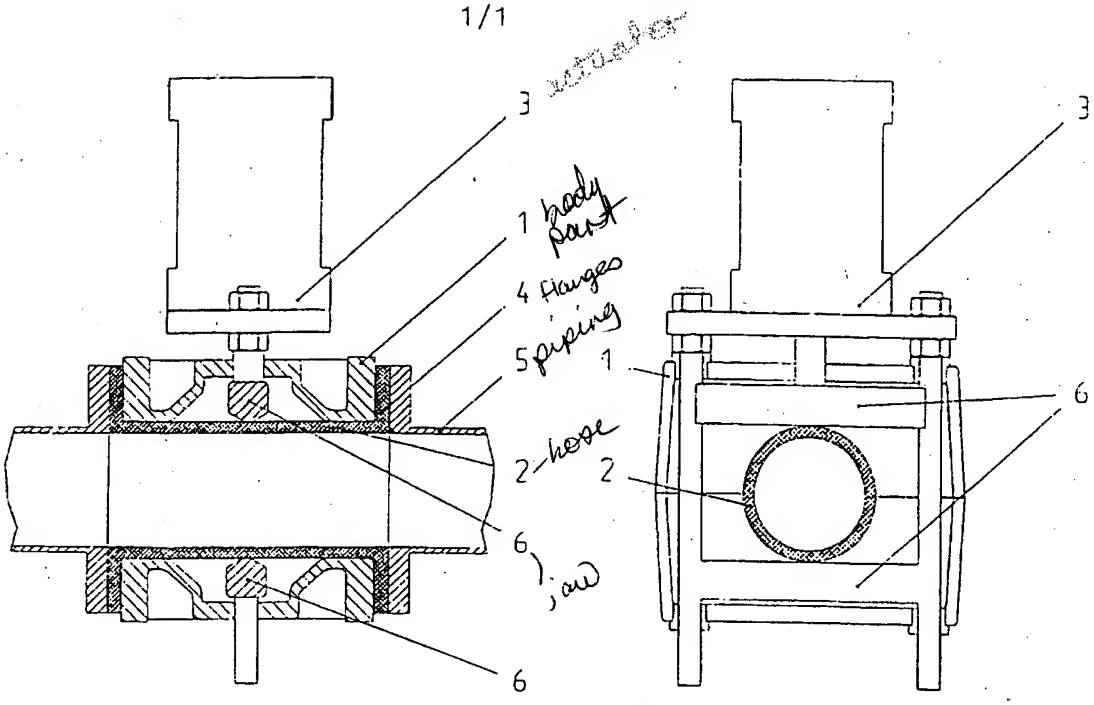

Fig. 1

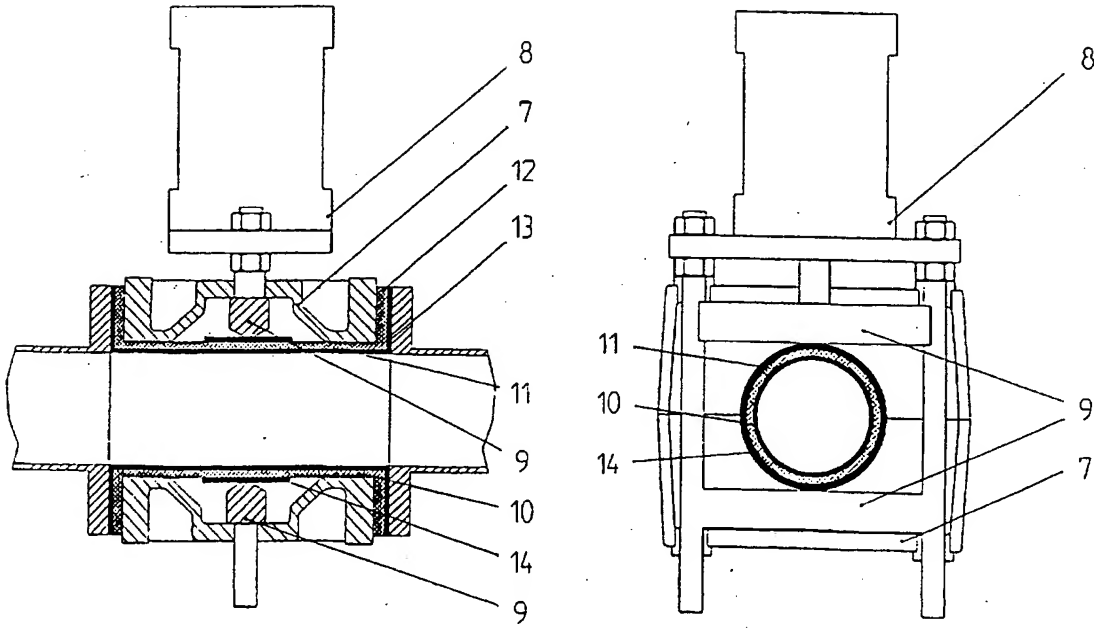

Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 97/00463

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: F16K 7/06
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: F16K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3811649 A (PRESS ET AL), 21 May 1974 (21.05.74), column 1, figures 3,4, claim 1 --	1
Y	DE 3102363 C2 (DEUTSCHE ITT INDUSTRIES GMBH), 3 November 1983 (03.11.83), figures 1,2, claims 1, 2 --	1-5
Y	EP 0175028 A1 (MIL MUTZARIM TECHNIIM), 26 March 1986 (26.03.86), figures 1-3,8a-9c, claims 1-12 --	1-5
A	GB 2274326 A (KODAK LIMITED), 20 July 1994 (20.07.94), figure 6, claims 1-6 --	1-9

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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International application No.
PCT/FI 97/00463

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 1079909 A (RENE ANREP. SURESNES), 14 April 1960 (14.04.60), figures 1-2, claim 1 -- --------	1-9

INTERNATIONAL SEARCH REPORT

Information on patent family members

01/10/97

International application No.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3811649 A	21/05/74	NONE	
DE 3102363 C2	03/11/83	NONE	
EP 0175028 A1	26/03/86	ZA 8407390 A	19/03/85
GB 2274326 A	20/07/94	DE 69309682 D	00/00/00
		EP 0649586 A,B	26/04/95
		US 5651058 A	22/07/97
DE 1079909 A	14/04/60	NONE	